π The Chronicle

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(circa) 3000 BC, Egypt

The pyramids are built. The sides and heights of the pyramids of Cheops and of Sneferu at Gizeh are constructed in the ratio 11:7. Hence:

$$\frac{1}{2}\cdot\frac{\text{perimeter}}{\text{height}}=\frac{22}{7}=3.142857$$

2000 BC, Egypt. The Rhind papyrus, oldest mathematical document in existence, gives the following rule for constructing a square having the same area as a given circle:

> Cut $\frac{1}{9}$ off the circle's diameter and construct a square on the remainder.

This gives: $\pi=\left(\frac{16}{9}\right)^2=3.1604\ldots$

950 BC, Israel. The commonly used approximation $\pi\approx 3$ is reported in the Bible (1 Kings 7:23; 2 Chronicles 4:2).

460 BC, Greece. Hippocrates tries to square the circle, and succeeds in squaring the lune.

414 BC, Greece. Aristophenes writes a play, *The Birds*, in which a geometer announces his intention to make a square circle. The term 'circle-squarer' is first applied to those who attempt the impossible.

300 BC, Greece. Euclid writes his best-selling book, *Elements*, but makes no contribution to π!

240 BC, Greece. Archimedes, engineer, architect, physicist and one of the world's greatest mathematicians, writes *Measurement of the Circle*. Using inscribed and circumscribed polygons of 96 sides, he shows that

$$3\frac{10}{71}<\pi<3\frac{1}{7}$$

213 BC, China. In this year, by edict of the Emperor, all books are burned and all scholars are buried. After the death of the Emperor, learning (but unfortunately not the scholars) revives again. Chang T'sang in his treatise *Arithmetic in Nine Sections* gives $\pi\approx 3$.

30 BC, Italy. Vitruvius, architect and engineer, measures distances using a wheel. He uses

$$\pi=3\frac{1}{8}=3.125$$

AD 125, Greece. Ptolemy writes his famous work on astronomy, *Syntaxis Mathematica*. In this work he gives π as 3° 8' 30", that is,

$$3+\frac{8}{60}+\frac{30}{60^2}=3\frac{17}{120}=3.14166\ldots$$

AD 480, China. Tsu Ch'ung-chih, expert in mechanics and interested in machinery, gives the 'accurate' value

$$\frac{355}{113}=3.1415929\ldots$$

1150, India. The Hindu mathematician Bhaskara writes on astronomy and mathematics, and gives several values for π. The most accurate of these is

$$\frac{3927}{1250} = 3.14160\ldots$$

said to have been obtained by calculating the perimeter of a regular polygon of 384 sides.

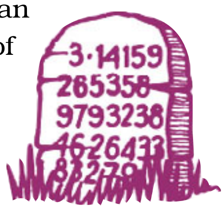
1579, France. The eminent French mathematician François Vieta finds π correct to nine decimal places by considering polygons of 6.2^{16} = 393 216 sides. He also discovers that

$$\frac{2}{\pi} = \frac{\sqrt{2}}{2}\cdot\frac{\sqrt{2+\sqrt{2}}}{2}\cdot\frac{\sqrt{2+\sqrt{2+\sqrt{2}}}}{2}\cdots$$

1580, Denmark. Astronomer Tyche Brahe uses the approximation $\pi \approx 3.1408$. Having lost his nose in a duel, Brahe wears a golden nose, attached to his face with a cement that he always carries with him.

1593, Netherlands. Adriaen van Rooman computes π correct to 15 decimal places using polygons of 2^{30} = 1 073 741 824 sides.

1610, Germany. Ludolph van Ceulen, having spent much of his life calculating π, gives it correct to 35 places. Later, the result is engraved on his tombstone.



1647, Belgium. The Jesuit, Gregory St Vincent, proposes four (incorrect) methods of squaring the circle. It has been said that, “No-one squared the circle with so much ability or [except for his principal object] with so much success!”

1650, England. John Wallis uses an extremely complicated and difficult method to obtain

$$\frac{4}{\pi} = \frac{3.3.5.5.7.7.9\ldots}{2.4.4.6.6.8.8\ldots}$$

Lord Brouncker, first president of the Royal Society, converts the result to a continued fraction:

$$\frac{4}{\pi} = 1 + \cfrac{1^2}{2 + \cfrac{3^2}{2 + \cfrac{5^2}{2 + \ldots}}}$$

1668, Scotland. James Gregory investigates the series

$$\arctan x = x - \frac{x^3}{3} + \frac{x^5}{5} - \frac{x^7}{7} + \ldots$$

Gregory also attempts to show that squaring the circle is impossible.

1699, England. Abraham Sharp calculates π to 72 decimal places by taking

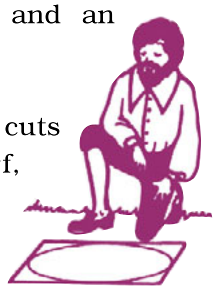
$$x = \frac{1}{\sqrt{3}}$$

in Gregory’s series.

1706, England. William Jones first uses the symbol π to denote the ratio

$$\frac{\text{circumference of circle}}{\text{diameter of circle}}$$

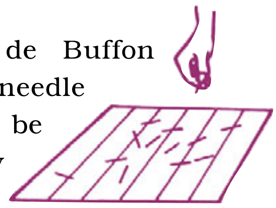
1706, England. Machin computes π to 100 places using Gregory’s series and an identity.



1753, France. M. de Causans cuts out a circular piece of turf, squares it, and claims to have deduced original sin, the Trinity and π = 4 from the result.

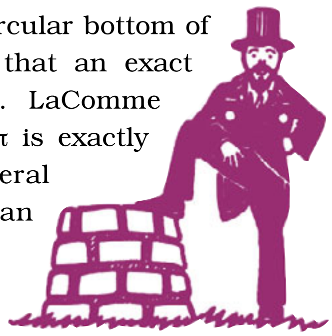
1755, France. The French Academy of Science refuses to examine any more ‘solutions’ of the circle-squaring problem.

1760, France. Comte de Buffon devises his famous needle problem in which π may be determined by probability methods.



1761, Germany. Lambert proves that π is irrational (i.e., not expressible as a fraction).

1836, France. A well-sinker, LaComme, requests information from a mathematics professor regarding the amount of stone required to pave the circular bottom of the well, and is told that an exact answer is impossible. LaComme later announces that π is exactly $3\frac{1}{8}$ and receives several medals from Parisian societies!



1844, Germany. Dase, the lightning calculator, finds π correct to 200 places using Gregory's series. Dase is able to mentally calculate the product of two 8-digit numbers in 54 seconds, two 40-digit numbers in 40 minutes, two 100-digit numbers in 8 hours and 45 minutes.

1873, England. The mathematician William Shanks computes π to 707 places after labouring for 15 years.

1882, Germany. A number x is *algebraic* if it satisfies an equation

$$a_n x^n + a_{n-1} x^{n-1} + \ldots + a_1 x + a_0 = 0$$

where the coefficients are all integers. Otherwise it is transcendental. Lindemann shows that π is transcendental.

1897, USA. The General Assembly of the State of Indiana attempts to legislate the value of π. The Bill passes the House, but because of newspaper ridicule is shelved by the Senate.

1913, India. The interesting mathematician Ramanujan contributes several noteworthy approximations of π. One of these is

$$\left(9^2 + \frac{19^2}{22}\right)^{\frac{1}{4}} = 3.141592652\ldots$$

1949, USA. The all-electronic calculator Eniac computes π to 2035 places in about 70 hours.

1961, USA. Wrench and Shanks use an IBM 7000 to calculate π to 100 265 decimal places.

2005, USA. Dave Anderson has calculated the first 200 million digits of π. You can check them out at www.angio.net/pi/piquery !

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From Helen Prochazka's Scrapbook

That's Mathematics
A song by satirist and Harvard lecturer Tom Lehrer

Counting sheep
When you're trying to sleep,
Being fair
When there's something to share,
Being neat
When you're folding a sheet,
That's mathematics!
When a ball

Bounces off of a wall,
When you cook
From a recipe book,
When you know
How much money you owe,
That's mathematics!

How much gold can you hold in an elephant's ear?
When it's noon on the moon, then what time is it here?
If you could count for a year, would you get to infinity,
Or somewhere in that vicinity?

When you choose
How much postage to use,
When you know
What's the chance it will snow,
When you bet
And you end up in debt,
Oh try as you may,
You just can't get away
From mathematics!

Andrew Wiles gently smiles
Does his thing and voila.
QED we agree and we all shout horrah,
As he confirms what Fermat
Jotted down in that margin
Which could've used some enlargin'.

Tap your feet,
Keepin' time to a beat,
Of a song
While you're singing along,
Harmonize
With the rest of the guys,
Yes, try as you may,
You just can't get away
From mathematics!

Hooray for new math,
New-hoo-hoo-math,
It won't do you a bit of good to review math.
It's so simple,
So very simple,
That only a child can do it!